

AL-SR-1992-0013



ARMSTRONG

**IMPLEMENTING TOTAL QUALITY  
MANAGEMENT (TQM) II:  
A FACILITATOR'S GUIDE**

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LABORATORY

**December 1992**

**Interim Special Report for Period November 1990 – November 1991**

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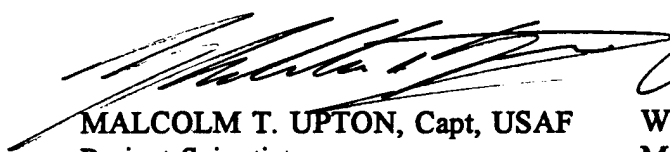
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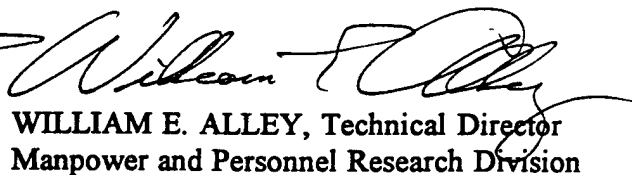
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# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE  
December 1992

3. REPORT TYPE AND DATES COVERED  
Interim - November 1990 - November 1991

4. TITLE AND SUBTITLE

Implementing Total Quality Management (TQM) II: A Facilitator's Guide

5. FUNDING NUMBERS

PE - 62205F  
PR - 7719  
TA - 20  
WU - 27

6. AUTHOR(S)

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Armstrong Laboratory  
Human Resources Directorate  
Manpower and Personnel Research Division  
Brooks Air Force Base, TX 78235-5352

8. PERFORMING ORGANIZATION  
REPORT NUMBER

AL-SR-1992-0013

9. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY  
REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This Special Report deals with a tool to facilitate the transition from a traditional management environment to a Total Quality Management (TQM) environment through the use of the Methodology for Generating Efficiency and Effectiveness Measures (TQM/MGEEM). It provides TQM facilitators with a step-by-step explanation of the TQM/MGEEM process for building a quality measurement system based on an organization's mission statement and customer needs. Preparation of the organization for reception of a TQM measurement system as well as preparation for the development sessions is discussed. The team mindset a facilitator needs to cultivate and potential pitfalls that a facilitator may encounter are discussed. The membership of the development teams as well as each of the tasks that the teams need to accomplish (review of mission statement, identification and prioritization of customers and suppliers, identification of Key Result Areas, development of indicators, and Mission Effectiveness Charts) are discussed. A brief discussion of how to use the development TQM/MGEEM measurement development system is also included.

14. SUBJECT TERMS

Facilitation  
Management  
Measurement  
Methodology for generating efficiency and effectiveness measures

MGEEM  
Quality  
Total quality management  
TQM

15. NUMBER OF PAGES

38

16. PRICE CODE

17. SECURITY CLASSIFICATION  
OF REPORT  
Unclassified

18. SECURITY CLASSIFICATION  
OF THIS PAGE  
Unclassified

19. SECURITY CLASSIFICATION  
OF ABSTRACT  
Unclassified

20. LIMITATION OF ABSTRACT  
UL

## Table of Contents

Introduction . . . . .	1
Preparation . . . . .	1
Preparing the Organization . . . . .	2
Preparing for the Implementation of TQM/MGEEM . . . . .	2
TQM/MGEEM Steps And How To Take Them . . . . .	5
Mindset and Potential Pitfalls . . . . .	5
Players on the Blue Team . . . . .	6
Actions of the Blue Team . . . . .	7
Review the Mission Statement . . . . .	7
Identify and Prioritize Customers and Suppliers . . . . .	8
Identify Key Result Areas . . . . .	11
Players on the Gold Team . . . . .	14
Actions of the Gold Team . . . . .	14
Develop Indicators for KRAs . . . . .	15
The Indicator Weighing Table . . . . .	17
Developing Mission Effectiveness (ME) Charts . . . . .	20
Using TQM/MGEEM To Maximum Benefit . . . . .	22
Using the ME Charts - the Feedback Team . . . . .	23
Feedback . . . . .	24
Improving the System . . . . .	24
Appendix A: A Facilitator's Checklist for the TQM/MGEEM Process . . . . .	27
Appendix B: Blank ME Chart . . . . .	28

## Table of Figures

Figure 1	Arrangement of Team Members. . . . .	4
Figure 2	Example Blue Team Membership. . . . .	7
Figure 3	Systems Diagram. . . . .	9
Figure 4	Results of Customer NGT. . . . .	10
Figure 5	Pareto Chart of Voting Results. . . . .	10
Figure 6	Sample Key Result Area Voting Card. . . . .	12
Figure 7	Recording a Sample Key Result Area Vote . . . . .	13
Figure 8	Example makeup of the Gold Team. . . . .	14
Figure 9	Types of measures. . . . .	15
Figure 10	Fishbone to Mission Effectiveness Chart. . . . .	17
Figure 11	Indicator Weighing Table. . . . .	18
Figure 12	Weighing Table With Feasible Best Columns Complet- ed. . . . .	19
Figure 13	Completed Indicator Weighing Table. . . . .	20
Figure 14	Examples of Finished ME Charts. . . . .	21
Figure 15	Starting an ME Chart. . . . .	21
Figure 16	Finished ME Chart. . . . .	22
Figure 17	Deming Cycle. . . . .	23

## Preface

The information reported here on Total Quality Management/Methodology for Generating Efficiency and Effectiveness Measures (TQM/MGEEM) is part of the Armstrong Laboratory's program to provide tools and technologies to measure and enhance organizational quality and effectiveness. TQM/MGEEM is a significant breakthrough in quality measurement which provides a powerful set of new tools for improved leadership and management and a means of periodically soliciting worker input to identify barriers to performance.

This is the second in a series of four special reports written to document TQM/MGEEM. The first is intended for commanders and leaders of organizations and describes their primary responsibilities and what is necessary to start a TQM/MGEEM effort. The purpose of this report is to provide TQM facilitators with a step-by-step guide to the measurement system development process that is an integral part of TQM/MGEEM. The third report explains to leadership and facilitators how a TQM/MGEEM measurement system is used to institute and cultivate a climate of continual improvement and how Process Improvement Teams (PITs) fit into the TQM/MGEEM picture. The fourth report is intended as a general reference work for both leadership and facilitators, providing additional details on numerous aspects of the TQM/MGEEM technology, TQM and measurement philosophy, and several of the techniques found in the TQM/MGEEM system.

The authors thank Mr. Larry T. Looper for his invaluable ombudsmanship in support of this research. We also thank the scores of people at conferences, presentations and test sites that have provided valuable insight and feedback toward the continual improvement of both TQM/MGEEM and our presentation of it.

## Implementing Total Quality Management (TQM) II: A Facilitators Guide

### Introduction

This special report is the second in the 1992 series of guides on implementing Total Quality Management (TQM) with the Methodology for Generating Efficiency and Effectiveness Measures (TQM/MGEEM). As the technology first documented in earlier technical papers (Tuttle & Weaver 1986, Weaver & Looper 1989) has continued to improve, the need for revised and updated documentation has become apparent, resulting in this series. This is a step-by-step guide for use by facilitators in developing a unique measurement system that will allow a target organization to better implement TQM.

The first in this series, subtitled "The Command Imperative," addresses the role of top management in implementing TQM and is intended primarily for the leadership in a target organization (Weaver & Upton, 1992a). The third of this series discusses the role of a TQM/MGEEM measurement system and feedback meetings in the process of continual improvement and is intended for use by TQM facilitators and the members of the feedback team (Weaver & Upton, 1992b). The fourth of this series is a general reference work providing more detailed explanations of TQM/MGEEM, how it relates to TQM, and other topics (Weaver, Upton & Frank, 1992). It is a valuable reference for all personnel involved in a TQM/MGEEM effort.

### Preparation

It is assumed that the readers are familiar with the terms and ideals of the philosophy generally known in the Air Force as Total Quality Management (TQM). The Navy refers to it as Total Quality Leadership, while it is often referred to Total Quality in Japan and among much of corporate America. If such is not the case and the reader needs knowledge of TQM in general, several books provide a good introduction to the topic. The first we generally recommend is one of the two books on the Deming philosophy written by Mary Walton, The Deming Management Method (1986) and Deming Management at Work (1990). A good follow on to one of these two is the book The Deming Guide to Quality and Competitive Position (1987) by Howard and Shelly Gitlow and The Deming Route to Quality (1988) by William Scherkenbach. When the learner has a basic grasp of the concepts involved they are ready to tackle the more challenging presentation found in Dr. Deming's own Out of the Crisis (1986). Also helpful is the book Juran on Leadership for Quality (1989) by Dr Joseph M. Juran which explains his contributions to the body of TQM knowledge and philosophy. With this knowledge one is ready to embark on a TQM/MGEEM journey.

## Preparing the Organization

Implementing TQM/MGEEM in an organization will not "install" TQM. To the contrary, using TQM/MGEEM in an organization that is not implementing the Deming philosophy (Deming, 1986) will only result in the imposition of yet another tool for micro-management; to be gamed, avoided, tricked and ultimately scrapped as an impediment to productivity and quality. Therefore, the establishment of the quality councils, studying the teaching of Dr Deming and the institution of training in the area of TQM are necessary preconditions to successful use of TQM/MGEEM. The reader is referred to Weaver & Upton (1992a) for more details on leadership's obligations in implementing TQM.

## Preparing for the Implementation of TQM/MGEEM

In Out of the Crisis, Dr Deming tells his readers that they need "other knowledge" to help toward improvement (Deming, 1986). A facilitator's job is to provide this "other knowledge." Toward this end a facilitator must take several steps to prepare for implementation of TQM/MGEEM. The first is for the facilitator to gain rudimentary knowledge of what the target organization does and how it is structured. If the facilitator is a member of the target organization, the knowledge he/she already has is usually sufficient. If, however, the facilitator is from outside the organization, especially if he or she is from a dissimilar work environment, some basic familiarization is necessary. This does not mean facilitators need to understand exactly what the target organization does and how it does it. Such a deep understanding implies that the facilitator will be building a system of measurements, which is not the case. The facilitator's role is one of moderator, not architect, a role of scout and guide, not trail boss and leader. The facilitator guides teams within the target organization through a process by which organization members themselves build a system that will serve as a basis for improvement. It is important to understand that improvement, not measurement, is the ultimate aim of a TQM/MGEEM implementation effort. A review of the organizational structure chart and some brief discussion with the top management involved, as to the mission of the organization, will help a facilitator better understand the ideas that teams within the target organization will be shortly presenting to him/her. This will bring about a smoother flow of ideas and information in TQM/MGEEM measurement development sessions.

The second step in preparation for TQM/MGEEM measurement development is to identify the members of the two teams that will directly participate in implementation. Detailed discussion of who should be on each team is found in the following sections entitled "Players on the Blue Team" and "Players on the Gold Team". Simply put, the Blue Team is a top and middle management team and the Gold Team is a middle management and worker level team. As for numbers of participants, suffice it to say that each team, Blue and Gold,



should consist of between 8 and 12 people to facilitate the discussion. More than 12 participants rapidly degrades the ability of the groups to provide a smooth flow of ideas, unnecessarily lengthening the TQM/MGEEM measurement development process. Less than 8 may damage the team's ability to gather the needed broad base of perspective and support necessary for the design and implementation of a rational measurement system.

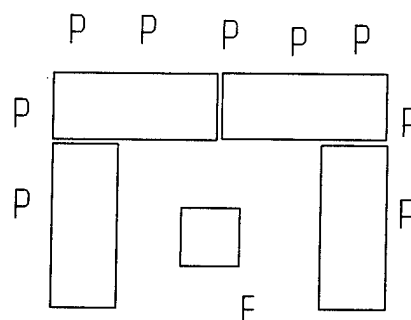
Sometimes a target organization is sufficiently small to place all members of the organization and the selected customer and supplier representatives on one team without making it too unwieldy. If this is the case and the groups desire to take this course then by all means proceed. It is also useful to designate one of the team members as the recorder for the team, responsible for keeping a record of the various documents and lists developed. This usually takes the form of one of the team members taking the various working documents on chart paper and overheads back to a secretary and having them typed up, copied and distributed. Often the commander of the target organization will volunteer for this duty unasked as he or she is usually eager to demonstrate to their subordinates and to the facilitator their commitment to the TQM/MGEEM process as well as being in the most logical position to get the secretarial support.

After identifying the members of the Blue and Gold Teams, sufficient time must be set aside for conducting the development sessions. There are no hard and fast rules about how long TQM/MGEEM takes, but some rules of thumb may be helpful. First more service-oriented organizations may take more time than production-oriented ones to get measures of what the organization does even though it has been shown in countless service organizations that TQM/MGEEM also works well in these environments. Second, the less specific the mission of the target organization, the longer the Blue and Gold Teams will take to accomplish their tasks. This usually applies to the higher echelons in an organizational hierarchy (e.g. command staff) or those with less identifiable products/services (e.g. research and development centers). Despite their difficulties with less concrete mission statements, TQM/MGEEM works well when such missions have been clarified. Third, the more people involved in the working groups, the longer the process usually takes. This is why the size of the groups should usually be limited to about a dozen participants. With these guidelines in mind, TQM/MGEEM has taken from as little as 4 hours for a small Security Police work-center to as long as 2 weeks for the headquarters of a research laboratory. Usually, however, about 8 to 12 hours (over 2 or 3 days) is sufficient. In general, it is suggested that the Teams set aside enough consecutive half days (4 or more hours, i.e. all morning or all afternoon) to complete their tasks without significant time lapses between sessions. Usually 3 half-days for the Blue Team are sufficient while 2 half-days for every 3 KRAs plus a half day for the weighing

table and Mission Effectiveness (ME) charts is usually enough time for the Gold Team to complete their tasks.

The choice of meeting location for the teams can immensely aid a successful TQM/MGEEM experience. Often it is helpful, especially at the upper echelons of an organization, to hold the TQM/MGEEM sessions at a physically separate site, perhaps even in a different part of the base or city to avoid lost time due to "I'll be back from my office in a minute," or "urgent" phone calls taking key participants away. The meeting room should be comfortable and quiet as participants will be working hard on building a system that is right for them. There should be plenty of room for each participant to spread out and write, and the room should be arranged to allow everyone to see both the overhead projector screen and the walls where chart paper with ideas written on it will be hung. It is helpful to have tables arranged in a "U" shape with the opening facing the front of the room and the participants seated around the outside edge (see Fig. 1). This aids the facilitator in maintaining the correct atmosphere and mindset among the participants and allows all the team members to see everything with a minimum of trouble. Although not required by anything in the TQM/MGEEM process itself. This facilitator has found that refreshments are often called for (at least in a good natured way). How the leadership of the target organization wishes to handle this is up to their discretion.

Finally, some basic supplies are needed to facilitate the TQM/MGEEM implementation process. These include an overhead projector and screen, both for pre-briefing the various steps and to help develop ME charts, to be described later in the last step in the process. An easel with a supply of chart paper, along with markers for writing on it, should also be available. A whiteboard can also be very useful for listing the ideas of the participants and or working on the mission statement with the Blue Team. Each team member should have about 50 3x5 index cards or similar-sized pieces of paper for the voting portions of the process, as well as notepaper and writing implements. It is often a good idea, especially if the facilitator is from outside the organization, to provide each person with a name card on which they can write the name they wish the facilitator to use when calling on them. Once all the preparation is finished, TQM/MGEEM system development can begin.



F = Facilitator

P = Participant

**Figure 1** Arrangement of Team Members.

## TQM/MGEEM Steps And How To Take Them

Following is a discussion of each of the steps of the TQM/MGEEM implementation process and the participants in each step. Included under each heading is information to help the facilitator lead the two working teams to consensus on the products of each step. Before beginning mission statement review with the first team (called the Blue Team), a brief outline of the entire process is often helpful to orient participants. (See "The MGEEM Process", Weaver, Upton & Frank, 1992 or use the outline in Appendix A of this publication). When the second (Gold) team meets a repeat of this outline as well as a summary of the results of the steps thus far, is useful. This summary of results is best accomplished with the active help of the overlap members of the Gold Team (i.e. the members that were also on the Blue Team).

### Mindset and Potential Pitfalls

The facilitator should inform both groups before the start of their efforts of the mindset that will make the deliberations more fruitful. The members of each team should play "boss for a day," taking the viewpoint of the commander or manager of the organization throughout the process. As much as possible the team members, in keeping with Dr Deming's point #9 (optimize team efforts toward the aims of the entire organization), (Deming, 1986) should take the perspective of the whole organization rather than the more parochial perspective of their particular part of the organization. The facilitator should encourage each team member to listen to both the facilitator's instructions and the ideas and thoughts expressed by their fellow team members. The reason for some of the actions they will take will not be clear at the time they take them, encourage them to not jump ahead but to trust the process. The TQM/MGEEM measurement development process has been tested in a myriad of organizations and when accompanied by a true commitment to TQM has always achieved superb results. If team members put their trust into the process, chances are good that they will be more than happy with the result.

There are some potential pitfalls that the facilitator should be aware of and seek to avoid. One of the most potentially harmful for the group and the most emotionally draining for the facilitator to avoid is too much facilitator influence. There is a fine line to tread here. On the one hand the facilitator's job is to keep the process moving forward at a reasonable pace and attempt to steer the participants away from "rabbit chasing." On the other hand, if the facilitator attempts to exert too much control, especially if the facilitator suggests changes in the system, the group will tend to lose their sense of ownership in the system, thereby defeating the purpose of this process. Unfortunately facilitators tend to be among the strongest proponents of TQM in an organization as well as being rather extroverted and willing to voice an opinion. For a facilitator to stifle such natural urges

to "tell them what's right" is emotionally draining but absolutely necessary for the success of the teams efforts.

Another pitfall is failing to properly control one or more disruptive members of a team. If a team member uses his or her position or rank or just irascibility to dominate the discussion the process will tend to be needlessly drawn out and stressful and potentially valuable ideas from other team members may be lost. If such a situation arises the facilitator should rely on the "rules of engagement," especially those dealing with discussion and voting during the Nominal Group Technique (NGT) to curb the disruptive team member. A very useful part of the NGT is the rule that all discussion is directed to the facilitator and the facilitator recognizes who has the floor. If team members begin to speak directly to one another, a simple, "To me, please" is often sufficient reminder. A final option is for the facilitator to take the person aside, say at a break, and explain that their behavior is, in the facilitator's judgement, impeding the process. If necessary the facilitator may later add that they disruptive member may produce a discontinuation of the effort. This strategy is only effective if the facilitator has the support of the superior, something that should be ensured as a matter of course before the process begins.

#### Players on the Blue Team

The Blue Team usually consists of the commander of the target organization, the commander's immediate superior, the commander's immediate subordinates, and some representative customers and suppliers. Having the commander's superior on the Blue Team provides linkage with the next higher level in the organization. Having the commander's immediate subordinates as team members provides for participation by "middle" management, and the customers and suppliers can provide valuable insights into customer expectations and supplier capabilities. The non-organizational members all can provide valuable insights as the organizational members examine and explain to outsiders what the organization does.

The membership of the Blue Team is defined in relation to the target organization and the definition itself is open to alteration by the organizations members. For each target organization the make up may vary in a number of ways (e.g., the number of customers & suppliers, the presence or absence of the Boss's boss, the presence of non-direct subordinates, etc.). Furthermore, if a large organization is using TQM/MGEEM throughout its various levels and divisions, the same person may serve as a member on several different Blue Teams and as a member on the Gold Team for yet another level of the organization. The membership is all relative to the target organization. For example, consider the partial wiring diagram for a fictitious organization in Figure 2. In this example, LtCol Gomez is the Commander or Manager of the target

organization, his immediate superior, Col Brown, is also a member of the Blue Team. LtCol Gomez's three immediate subordinates (CMSgt Jones, Capt Perry and Maj Lee) sit on the Blue Team and four representative Customers and/or Suppliers (Lt. Kenny, Capt Wilson, MSgt Fite and Ms Carlson) round out this Blue Team's membership. If a Blue Team is built at the next lower level of the organization, say in the target organization supervised by Capt Perry, Capt Perry would serve on two different Blue Teams (one as immediate subordinate, and one as Commander/Manager). It is even possible that Capt Perry might serve on one or more additional Blue Teams as a representative customer and/or supplier.

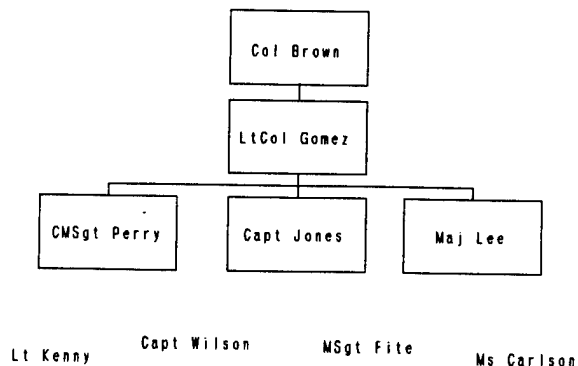


Figure 2 Example Blue Team Membership.

### Actions of the Blue Team

Review the Mission Statement. Dr. Deming's most recent statement of his first point (1990 version) encourages organizational leaders to "Create and publish a statement of the aims and purposes of the organization. Management must demonstrate to all employees their constant commitment to this statement." This indicates that developing a good mission statement and management's visible commitment to it is essential to the successful implementation of TQM. To this end, the first step in TQM/MGEEM is for the Blue Team to review the target organization's mission statement. Unfortunately, many organizations have insufficient and outdated mission statements, and often cannot even locate this valuable document. This step corrects this problem. Using either an old mission statement, or a "straw man" statement proposed by one of the participants, the Blue Team discusses what the organization does and how to formulate what it does into an understandable statement that everyone in the organization will be able to support and draw meaning from.

The facilitator should open the mission statement review process with some example mission statements. Examples from similar organizations at other locations, sister organizations in other services, and mission statements from higher levels in the organization's chain of command are all potentially useful inputs to the Blue Team. In addition, some brief training on the purposes of the mission statement (see Gitlow & Gitlow, 1987) may be appropriate.

It is helpful if there is some document for the Blue Team to start with. This can be an old mission statement taken from the

organizational chart book, or one of the examples mentioned previously. It could also be something made up specifically for this occasion by one of the members of the Blue Team. If the latter, it should be emphasized that this is a "strawman" and will probably have extensive surgery done to it before it is acceptable to the Blue Team. This will avoid hurt feelings and the acceptance of a less than optimal statement to avoid them. The mission statement is too important for one person's ego, no matter who that person may be, to get in the way of a quality product. The mission statement is the cornerstone upon which the rest of the TQM/MGEEM process and indeed the activities of the organization rest. It flows, after all, from Dr Deming's first point. Facilitators benefit enormously in their TQM/MGEEM work from gaining an understanding Dr Deming's philosophy before starting work with their first Blue Team.

The starting mission statement should be displayed on an overhead projector or whiteboard so that changes can be made directly to the document and evaluated and discussed by the entire Blue Team. When displaying the starting statement on the overhead or board, the facilitator should leave space for corrections and modifications. Often the new mission statement will bear only a slight resemblance to the original one due to the number of modifications made by the Blue Team. Give this step sufficient time and effort -- as mentioned before this document is the cornerstone of the TQM/MGEEM process. If the Blue Team members are reluctant to begin this process because of fear or a feeling of unease, a structured idea generation process such as the NGT described in Weaver, Upton, & Frank (1992), can be used to develop thoughts or statements for the mission statement and these can be strung together in some manner to serve as the mission statement. This variant of the procedure bears a great resemblance to developing KRAS and using them to build a mission statement. Example Mission Statements as well as further thoughts on the Mission Statement can be found in TQM IV.

Identify and Prioritize Customers and Suppliers. After the mission statement has been discussed, clarified and agreed to, or perhaps as part of that process (e.g. to sharpen the customer focus that a good mission statement should have, Gitlow & Gitlow, 1987), the Blue Team should identify and prioritize customers and suppliers. In this step the team will get its first introduction to the use of the NGT (described in Weaver, Upton, & Frank, 1992) along with the first of the two NGT voting strategies recommended in TQM/MGEEM. It is helpful before this step begins for the group to understand two ideas. One is the NGT process that will be used and the other is the systems model of organizations. (See "The Nominal Group Technique," "Basic System (Input-Output) Model" and "Performance and Measurement" in Weaver, Upton, & Frank, 1992 for a discussion of these items).

The facilitator's introduction of the ideas of customers being all organizations or persons affected by an organizations output, that the outputs are information and services as well as products, etc. should conclude with definitions of customers and suppliers. Customers and suppliers will be called upon in the future to provide inputs to improve processes within the target organization and, therefore, should be identified with a particular person or persons or at least a specific office symbol. Customer and supplier identifications that are too nebulous, such as "the nation" or even "the Army" or "the Air Force," should be discouraged. Facilitators are urged to study the work of Dr. Juran on customers and suppliers (Juran, 1989). This work includes definitions of customers and suppliers, knowledge that customers and suppliers are internal as well as external, and the famous triple role (TRIPROL) concept. His teachings on the triple role of organizations (as processor, customer and supplier), internal and external customers and his definition of a customer as anyone who receives or is affected by an organizations output should be made clear to the Blue Team.

During the customer and supplier identification process participants often note that although some suggested customers are definite customers and some suggested suppliers are definite suppliers, there are often suggested customers and suppliers that can be grouped as both suppliers and customers. This is a potentially valuable insight especially if arrived at by the Blue Team members themselves and not explained to them by the facilitator. This insight is correct and reinforces the importance of the two-way feedback arrows in the systems diagram (Fig 3). Knowledge of and appreciation for customers and suppliers is an important first step on the road toward sensitivity and eventual active solicitation of customer feedback and pursuit of more harmonious supplier relationships. If by the end of the supplier identification process the Blue Team has not had this insight, it should be given to them by the facilitator.

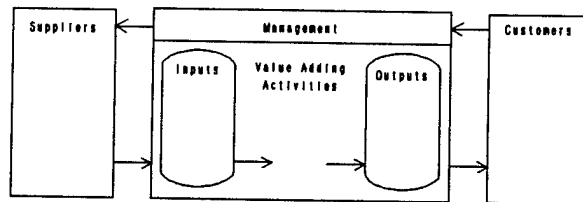


Figure 3 Systems Diagram.

To begin the customer identification process each person should be provided with a copy of the new or revised organizational mission statement, or the mission statement should be placed where all can see it. The facilitator should then pose the customer identification nominal question, "Who are the customers of [organization name]?" Alternately, the question can be worded in accordance to Dr Juran's ideas on customers (Juran, 1989) as "Who receives the outputs of [organization name]?"

When the voting phase of the NGT is reached, participants are instructed to vote on the customers they think are most critical.

It is understood in the TQM context that all customers are important, but a relatively small percentage of them are critical to the success of the organization. This is based on the Pareto principle as it applies to customers. This principle states that a relatively small portion of a group is responsible for the majority of the importance of that group (i.e. 20% of the organization's customers are critical because they consume 80% of the organizations output).

The number of customers each participant may vote for is dependent on the number of customer names left after the discussion and clarification phase. A rule-of-thumb is to allow each participant to select between five and seven "critical customers." The number the facilitator chooses, whether three, five, seven or some other number, is left to the facilitator's discretion and the characteristics of the voting technique used, but it is suggested that no more than half the total number of customers be given as the number of votes for each person. Participants write the names and identifying number of the selected customers, one per card, on 3x5 index cards or similarly sized pieces of scratch paper. The cards are turned in and participants take a short break while the votes are tallied by the facilitator.

To report the results of the voting the facilitator should make a Pareto chart of the results to identify the "critical few" customers as opposed to the "important many". (A sample vote is found in Fig 4, the resulting Pareto chart in Fig 5). It is these critical few customers with whom the organization needs to build strong contacts in order to define and improve the quality of their operations.

The facilitator then repeats the same identification process for suppliers. Facilitators should bear in mind that the purpose of identifying and prioritizing is twofold. First, to provide the organization with a more definitive list of customers and some idea of their relative importance, and secondly to begin to encourage people to start thinking in a more holistic manner, considering their customers' needs and suppliers' capabilities in their day-to-day activities. Any list of critical and important customers and suppliers that affects the attitude change toward the teachings of TQM and provides a starting

1 -- 1	6 -- 2
2 -- 1	7 -- 2
3 -- 0	8 -- 1
4 -- 6	9 -- 0
5 -- 4	10 -- 1

Figure 4 Results of Customer NGT.

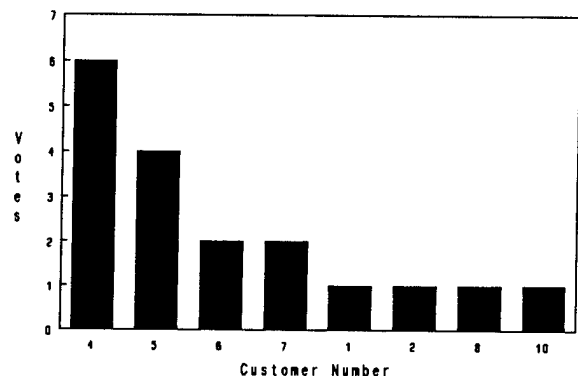


Figure 5 Pareto Chart of Voting Results.



point for building relationships with customers and suppliers is a valuable list.

Identify Key Result Areas. The next step in the TQM/MGEEM process and the last step for the Blue Team is to identify Key Result Areas (KRAs). KRAs are the component parts of the mission statement, the small, measurable pieces of the job the Air Force pays the target organization to accomplish. The facilitator should explain that the best KRAs are the make or break portions of the mission: readiness for a flying wing, customer service for a supply function, timeliness for a service organization. KRAs should be a realization of customer expectations, not a process, tool, or method to achieve those results. A copy of the revised mission statement for each participant, or displaying the revised mission statement either on a whiteboard, chart paper, or overhead projector can serve as a valuable touchstone for the Blue Team members. Some examples of KRAs can be found in Weaver, Upton, & Frank (1992).

The NGT is again used to identify KRAs. The Blue Team generates answers to the following nominal question: "What categories of results is this organization expected to accomplish?" or more simply "What does the Air Force pay [organization name] to do?" After silent generation and round-robin listing, the Blue Team may have a plethora of potential KRAs. Some will be synonyms or close synonyms and are often combined in the discussion and clarification phase. Other suggested KRAs will not be viewed by the Blue Team as critical and will drop out, either in the discussion phase or, more probably, in voting. The Blue Team should be assured that voting will take care of non-critical KRAs, and that discussion and clarification is usually not used to eliminate all of them. While listing KRAs, plenty of space should be left between each one to allow for wording changes during the discussion and clarification phase to follow. Occasionally it is useful after the discussion and clarification phase to go around the table asking each member of the Blue Team to choose their top KRA to advocate. The participant then chooses a KRA and tells the team why he/she thinks that KRA is the most important. More than one person may choose the same KRA. It is suggested that the supervisors of the target organization go last so that he/she will not unduly influence the expression of ideas. This option should be used judiciously, however. If there is fear, or reason for fear, in an organization, this will cause more distress than it is worth, but when the team is working well together this discussion often eliminates the need for voting altogether.

If all the excess KRAs are not eliminated, voting follows. Again any reasonable voting technique may be used. The example that follows uses the technique we personally prefer but if you or your group feel more comfortable with another voting technique, use it. In our example a Blue Team with six members arrives at a list of 12 potential KRAs after discussion and clarification. The

facilitator gives each team member five index cards to serve as voting slips during the voting phase. Each team member then writes the name of the five most important KRAs in the middle of the slips, one KRA per slip (see Figure 6). As a check to insure that the votes are tabulated correctly, they should also write the number designator of the KRA from the chart paper lists on the walls in the upper left hand corner of each card.

KRA #
KRA Name
Weight

**Figure 6** Sample Key Result Area Voting Card.

After all participants have chosen their five most important KRAs, each person lays all five cards in front of them on the table where all the choices can be seen at once. They are then asked by the facilitator the following question: "If you could have only one of the KRAs before you, which one would it be?" The facilitator tells the participants to write a five in the lower right hand corner of the card and turn it over. If the Blue Team is not using five cards, then each participant would give the first card chosen a weight equal to the total number of cards each person has been given (e.g. 7 points for this first rated card of seven votes). Next the facilitator asks, "Of the remaining choices, if you had to eliminate the least important one, which would it be?" This choice is given a one in the lower right hand corner and turned face down. Next the facilitator repeats the question, "If you could have only one of the remaining KRAs before you, which one would it be?" This KRA is given a weight of four in the lower right and turned over. Then the least important remaining KRA is located and so on until all the KRA choices have been weighted. The facilitator then collects the cards from all participants. Allow another short (ten minute) break to tabulate the results.

Results are tabulated in a manner similar to the tabulation of customer voting but with added information of the weights given each vote is also considered. First, separate the cards according to KRA numbers given when listed on chart paper (the number in the upper left hand corner). All votes for KRA #1 are placed in one pile, all for #2 placed in another pile, etc. Second, put the cards in each stack in order according to the weight in the lower right-hand corner of each card. Record the weight on a tally sheet as shown in Figure 7. In Figure 7, the first column is the number of the KRA in question. The second column is a list, in ascending order, of the weights given that KRA by each participant who voted for it. The final column is a summary of the voting information. It is expressed as the sum of the weights written above a dividing line and the number of votes for each KRA written below the di-

viding line in the manner of a fraction.

There are no rigid rules for interpreting voting results. These data are gathered so that the Blue Team as a whole will have a general idea of the relative importance the members attach to each KRA. The goal is to reduce the number of KRAs down to a parsimonious system. Such a system will provide a basis for improvement without imposing an undue burden on those being measured or producing information overload for those who need to interpret the data.

Facilitators are urged to read Tom Peters' book Thriving on Chaos (1987), especially the next to last chapter, for his ideas about the importance of making measurement systems simple, parsimonious, and useful.

A number of KRAs can be eliminated as a result of the vote. For instance, KRA 8 should probably be included in the system. It not only received a vote from each member but it also received the highest sum of weights (26). Although KRA 5 received a vote from each person, all of them apparently thought (assuming from the weak weights) it had relatively little value as compared with some of the other KRAs. The Blue Team may therefore decide to drop KRA 5, although this is not required. Although KRA 2 received only three votes, all three participants who voted for it ranked it high, with weights of 4 or 5. Dropping this KRA, which half the group felt was highly important, may alienate a substantial portion of the Blue Team and later a similarly substantial portion of the organization. Although it received the vote of only half of the participants, it should be dropped only after careful consideration by the Blue Team. Similar comments can also be made for KRA 4 (albeit to a lesser extent). On the other hand, KRAs 7, 9, and 11 could probably be dropped with little impairment to either the system or the comfort of the participants.

If consensus on a small set of KRAs cannot be reached after a first vote, a second and perhaps third vote may be necessary, culling some of the candidates each time. Once consensus has been reached by the Blue Team they are thanked for their efforts and dismissed. The results of their efforts are documented by the facilitator or the prearranged scribe and presented in writing to the Gold Team as they begin the work on the next part of the TQM/MGEEM process.

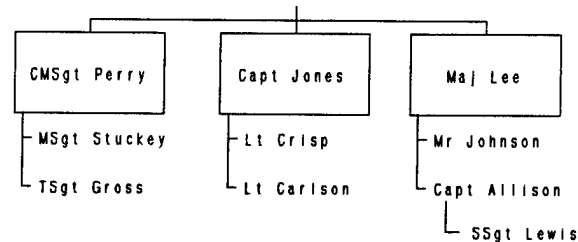
1	2,3	5/2
2	4,5,5	14/3
3	2,3	5/2
4	4,5	9/2
5	1,1,1,1,2,2	8/6
6	1,2,2	5/3
7	1	1/1
8	4,4,4,4,5,5	26/6
9	3	3/1
10	3,3	6/2
11	3	3/1

Figure 7 Recording a Sample Key Result Area Vote

### Players on the Gold Team

The members of the Gold Team again can only be described relative to the target organization in question. The commander's immediate subordinates, who were also on the Blue Team, and key workers (who are usually among the immediate subordinates of the commander or managers immediate subordinates) make up the membership of the Gold Team. The immediate subordinates provide for linkage between the two teams, and both they and the key workers are knowledgeable enough to build measures for the work that they do. Key workers are those workers who by virtue of their position or their innate charisma, are formal or informal leaders of the work force. By including these key workers, not only is the viewpoint of the workers represented effectively, but these workers will be able to return to their comrades and "sell" them on the idea of using the system since these work force leaders were part of the process of creating the measures. An example based on the fictitious organization used to illustrate the blue team may help

(Fig 8). CMSgt Perry, Capt Jones and Maj Lee again sit on the team as the immediate subordinates. The representative customers and suppliers are gone as well as the senior leadership (Col Brown and LtCol Gomez). We also have key workers on this team, six of whom are the direct subordinates of the three overlap members. The final member of the team



**Figure 8** Example makeup of the Gold Team.

(SSgt Lewis) is also a key worker, but is not a direct subordinate of one of the three immediate subordinates. SSgt Lewis may be a key worker because the section that Capt Allison leads is large and SSgt Lewis is a needed "second representative" of the leadership of that section, or perhaps SSgt Lewis is seen by LtCol Gomez, et al as being an informal spokesman for the work force--someone who is well-informed about their concerns and can better relate to the "front-line" workers.

### Actions of the Gold Team

The Gold Team is responsible for developing measures for the KRAS developed earlier by the Blue Team. Again a briefing on the overall TQM/MGEEM process would be helpful. Also helpful would be a few words about how measurement and inspection fit into the TQM philosophy (see Dr Deming's point #3, etc. (Deming, 1986)). The goal of improvement should be stressed and the measures need only be "good" enough to provide a basis for that improvement, they need not be overly precise.

Develop Indicators for KRAs. The first task for the Gold Team is to develop indicators for each of the KRAs identified by the Blue Team. Before beginning this step Gold Team members who were also on the Blue Team (commander's immediate subordinates) should informally brief the other members of the Gold Team about what was accomplished by the previous team. Each member of the Gold Team should have a copy of the Blue Team's results, including the mission statement, critical customers and suppliers, and a list of the KRAs. All Gold Team member questions should be answered by the previous Blue Team members.

A few words on three kinds of measures (Fig 9), sources of measurement data and the characteristics of a good indicator that can be very helpful to the Gold Team members at this time. The facilitator should explain to the Gold Team members that measures (indicators) come in three basic types. "Hard" measures (e.g. reject rates, on-time take-offs, on-time deliveries); "soft," more subjective measures, (e.g. customer survey ratings, expert opinions) and infeasible measures, or measures that cost more than they are worth. An example of an infeasible measure is an indicator suggested by a civil engineering squadron at one base. They initially suggested that a survey be sent to every person on the base once a month and that this multi-page survey be filled out, returned and tabulated to form a part of their indicator system. This noble idea was discarded, however, when it became obvious that a large man-hour investment would have to be made every month to handle the dissemination, collection and tabulation of the instrument, not to mention the base-wide investment of time away from immediate work to complete the questionnaire.

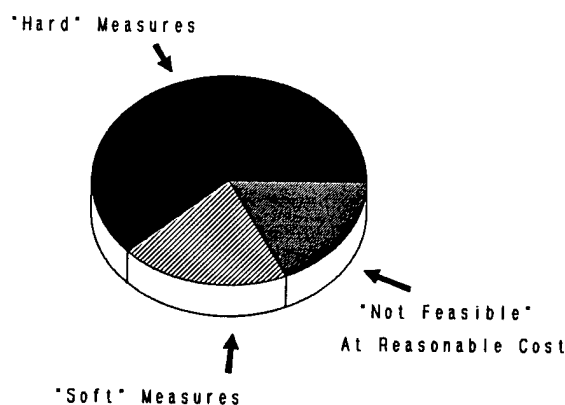


Figure 9 Types of measures.

The Gold Team should understand that indicator data can be gathered in a wide variety of ways. Of course the most preferred way is direct measurement of the work processes themselves, either through work sampling, efficiency measures of varying kinds, and/or timing measurements. Another, less desirable method may be gathering formal and informal feedback from customers and from members of the organization who interface with external customers. If none of these measures are available or obtainable at a reasonable cost, opinions of key workers or members of management using scales of various types can be used. Any of these sources of data can be used by the Gold Team as sources for their indicators if they keep in mind that the entire goal is to build measures that

will serve as a basis for improvement of the organizations mission execution.

Experience shows that good indicators share several common characteristics. For one, they are easily understood. They do not require extensive calculation or explanation. Good indicators are important and valid to leaders and workers involved in evaluating them. This means that both workers and leadership believe that the measure is meaningful (i.e., measuring the right things). Indicators should concentrate on outputs controlled by the target organization and not by outside forces, although major external inputs might be tracked in keeping with Dr Deming's point #4 concerning building a relationship with suppliers. The indicators should reflect efficiency (doing things right, output divided by input) as well as effectiveness (doing the right things, meeting customer needs). They should evaluate change by being responsive to actions taken by the target organization to improve the processes which drive them, should be cost efficient by using existing or easily gathered data, and do not need to be measured with extreme precision. Remember that measurement is not of key import, improvement is. Measures need only be good enough to serve as a basis for improvement. More information on measurement in general as well as examples of indicators can be found in Weaver, Upton, & Frank (1992).

Indicators are developed in a number of similar indicator development cycles (one cycle for each KRA). To generate indicators a repeat of the NGT process used for developing the KRAs is used. In this session the nominal question for each cycle is "What quantitative indicator(s) should the manager of [organization name] track on a periodic basis to tell whether the KRA is being accomplished?" For each KRA previously identified by the Blue Team, this question is used in a silent generation phase of the NGT. After going through all the steps of the NGT (from posing nominal question to vote tabulation) indicators for each KRA are generated.

Each indicator should have, in addition to it's letter designation, a name and a specification determined when the indicator is first suggested. The specification should include where the data are coming from, how the data are generated, the time period over which the data are tracked, and the interpretation of the values, i.e., whether a higher number better or worse. After voting has identified the final indicator or indicators for a KRA the facilitator should lead the Gold Team to determine a feasible best, a feasible worst and an indifference point for the indicator(s). Identifying these three values at this point is important because the reasoning behind their generation may fade and later steps may be rougher because of the values absence.

When correctly developed, each indicator is the result of a process important to fulfilling the mission of the organization,

the "head" of a fishbone diagram (Brassard, 1988) such as shown in Figure 10. Therefore the feasible best and feasible worst should be the boundaries of the processes capability. The feasible best is the best the target organization can reasonably expect from that process during the reporting period. The feasible best is not the arithmetic or absolute best but the best that can reasonably be expected if everything goes right in the

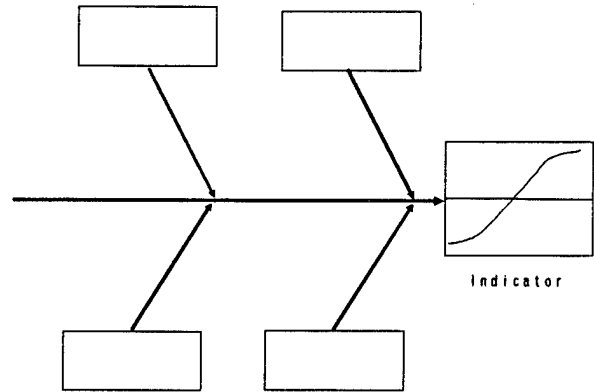


Figure 10 Fishbone to Mission Effectiveness Chart.

process which drives the indicator in question. Similarly, the feasible worst may not be the arithmetic or absolute worst but only the worst the target organization may do on an indicator if everything in the process behind the indicator that can reasonably go wrong does go wrong. The indifference point, sometimes referred to as the "don't rock the boat" point, is the performance level on an indicator at which the target organization is neither recognized for superior achievement nor criticized for lackluster performance. This is the point at which the indicator neither significantly adds to nor detracts from mission accomplishment. This indifference point may be a zone, a range between two numbers instead of an exact number. An example of these three points might be "percent of on time take-offs" where a flying squadron's historical high is 99% (less than the absolute high of 100%), a historical low might be 93%, and the indifference point (determined by the headquarters to be the command-wide average) may be 96%. The group may instead decide that they would have a zone between 95% and 97% as their indifference point. This may be a standard that has not been identified as arbitrary (in violation of Dr. Deming's point 11) or merely the reflection of the consensus of the team as to the policy of their organization.

The Gold Team should now put the indicator(s) for that KRA aside and go on to generate indicators for the next KRA. The Gold Team repeats this process until measures are generated for all the KRAs identified by the Blue Team. Once all indicators are identified, and only then, the Gold Team is ready to rank the indicators--one against another--in preparation for developing ME Charts.

The Indicator Weighing Table. One of the most powerful aspects of the measurement systems developed by TQM/MGEEM is the way in which indicators for different KRAs can be compared and decisions made about resource allocation and continual improvement. (This feedback process is discussed in Weaver & Upton, 1992b.) This requires that all indicator feasible bests and feasible worsts be ranked. This ranking is accomplished with an indicator weighing

table and makes possible the development of ME Charts, the heart of the TQM/MGEEM measurement system.

	Feasible Worst			Feasible Best			Indiff. Point
	Num	Rank	EP	Num	Rank	EP	
Provide Software Programming Efficiency	200			1000			600-700
Timeliness	-1.5			1.5			0.5
Provide Computer Services Uptime	90%			98%			97%
Access to Software	100			10			40-30
Provide numerical processing Meet customer needs	25%			0%			15%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

**Figure 11 Indicator Weighing Table.**

An indicator weighing table is developed by writing the names of all the indicators for all the KRAs in the first column as shown in Figure 11. (Note that the numbers for the feasible bests, worsts, and indifference points in the table are examples; it is not necessary to understand the specifics of how this fictitious Gold Team arrived at these numbers or exactly what the numbers represent.) The next three columns relate to the feasible worst for the indicators. The first of these columns, labeled "Num" contains the "feasible worst" scores that were determined for the indicators at the end of each indicator identification cycle the other two of these columns, labeled "Rank" and "EP" will be explained later. Columns 5-7 are the same as columns 2-4, but are for the feasible best score. The last column (labeled IP) contains the indifference point or zone for the indicator.

After the facilitator has completed the table to the point shown in Figure 11, the Gold Team is ready to begin. Concentrating first on the feasible best columns, the facilitator should pose the following question to the Team, "If everything went well and this organization scored its feasible best on all of its indicators, which score or scores would help your overall performance the most?" The indicator whose feasible best is the most helpful across all of the KRAs is then given a rank of 1 in column 6 (Feasible best -- Rank). After identifying the most helpful, the facilitator should ask, "Of the indicators remaining, if you were to score the feasible best on all of them, which one would help your overall performance the most?" This indicator receives a rank of 2. This process is repeated until all the indicator feasible bests have been ranked. If two or more indicator feasible bests are equally helpful to performance, then those indicators receive



an equal ranking (e.g. "Programming Efficiency" and "Meet Customer Needs" in the example).

After ranking all the feasible bests, an effectiveness point value is assigned to each. The EP value for the rank 1 indicator is set at 100 (column 7), and the facilitator asks the following question, "If the feasible best (ranked 1) is worth 100 effectiveness points, how many points is the feasible best ranked second? If it is almost as beneficial it would get 99 or 95 effectiveness points. If it is half as beneficial to effectiveness as rank 1 it would get 50 points, etc." The object is to determine how many points the second ranked feasible best is worth. In the example (Fig 12) the second ranked feasible best is assigned 90 effectiveness points. This process is repeated until all the feasible bests have been assigned an effectiveness point value. Note that an indicator with a lower ranking must have a lower effectiveness point value, even if it is only one point less, because the Team ranked it lower in impact on the mission.

	Feasible Worst			Feasible Best			Indiff. Point
	Num	Rank	EP	Num	Rank	EP	
Provide Software Programming Efficiency	200			1000	2	90	600-700
Timeliness	-1.5			1.5	1	100	0.5
Provide Computer Services Uptime	90%			98%	4	20	97%
Access to Software	100			10	3	60	40-30
Provide numerical processing Meet customer needs	25%			0%	2	90	15%

Figure 12 Weighing Table With Feasible Best Columns Completed.

This process is repeated for the feasible worsts for each indicator with two exceptions. First, negative effectiveness point values are assigned to the rankings instead of positive ones and, second, the feasible worst ranked 1 does not necessarily have to be assigned -100 points. It's a question for the Gold Team of how much damage to mission effectiveness the first ranked feasible worst can do relative to the benefit that the first ranked feasible best. In real life, these can be symmetrical, but don't have to be worth 100 points positive and negative. The facilitator should not allow the Gold Team to get bogged down in trying to get an exact effectiveness point value for each of the ranks. The difference between an EP rating of 90 and 95 is not important enough to spend a substantial amount of time on. Remember the goal is improvement of processes, not precise or hyperaccurate measurement. Also, it

should be understood that the indicator ranking of feasible worsts is usually not a mirror image of the ranking of the feasible bests. Often certain indicators, when done well, garner little added effectiveness but when done poorly (i.e. when the indicator approaches the feasible worst) then everyone begins to scream. An example of this would be "Uptime" in the previous three figures. If the computer is down, everyone screams, but if it is up 100 percent of the time one month, nobody notices. An example of the opposite case is, unfortunately, much rarer, but one possibility might be an indicator for morale (or quality work force) of "Awards". If nobody is getting anything, they don't know to complain, but if lots of awards are being garnered by the organization members, it will really increase morale. A completed Indicator Weighing table is shown in Figure 13.

	Feasible Worst			Feasible Best			Indiff. Point
	Num	Rank	EP	Num	Rank	EP	
Provide Software Programming Efficiency	200	5	-70	1000	2	90	600-700
Timeliness	-1.5	3	-80	1.5	1	100	0.5
Provide Computer Services Uptime	90%	1	-100	98%	4	20	97%
Access to Software	100	2	-95	10	3	60	40-30
Provide numerical processing Meet customer needs	25%	4	-60	0%	2	90	15%

(1)                      (2)      (3)      (4)      (5)      (6)      (7)      (8)

**Figure 13 Completed Indicator Weighing Table.**

With the completed Indicator Weighing Table in hand, the Gold Team is now ready to build their ME Charts.

Developing Mission Effectiveness (ME) Charts. An ME Chart is a graph upon which the Gold Team draws a line or curve reflecting policy on the relationship between the range of feasible values on an indicator and the impact on the overall mission effectiveness of the target organization. Example ME Charts based on the first two indicators in the Indicator Weighing Table shown in Figure 13 can be found in Figure 14. (Note that the Armstrong Laboratory has developed software to aid in the construction and maintenance of ME charts and indicator data (Upton, 1990)).

To begin the development of an ME Chart, the facilitator should take a blank chart (an example is in Appendix B from which

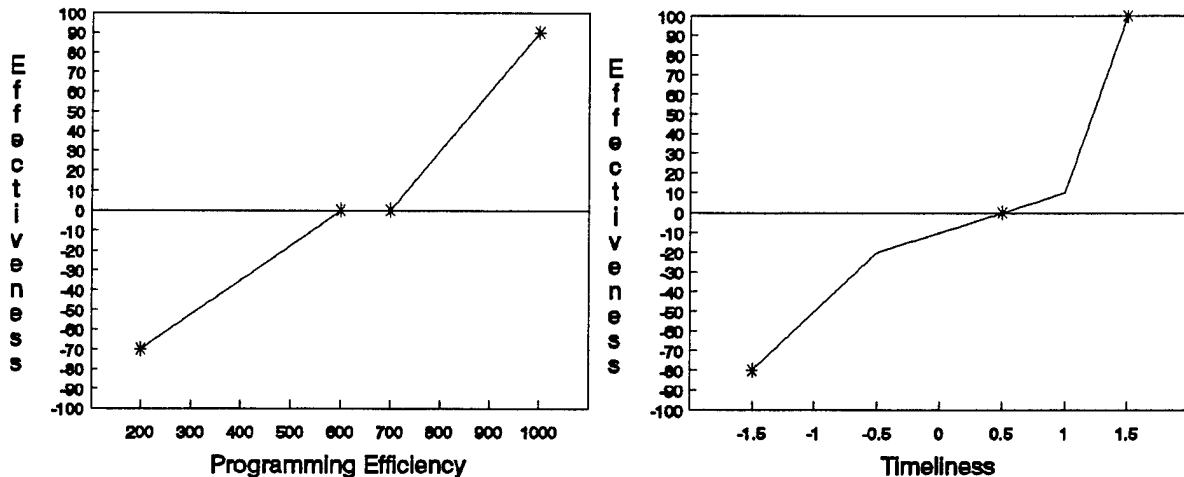


Figure 14 Examples of Finished ME Charts.

a transparency can be made) and draws the feasible worst, feasible best and indifference points previously decided upon by the Gold Team on the chart. Figure 15 shows an example of this for the "Uptime" indicator from the Indicator Weighing Table in Figure 13. The vertical axis of ME Charts should always run from -100 to 100 unless the ME points for feasible worst are a larger magnitude number than -100 (Weaver & Looper, 1989). In this case

the facilitator should allow the axis to extend from 100 down to whatever negative value is required by the Gold Team. To enhance the legibility of ME Charts the facilitator should leave some space on the charts to the left of the feasible worst (which is the left-most number on the horizontal axis) and some space to the right of the feasible best (the right-most number on the horizontal axis).

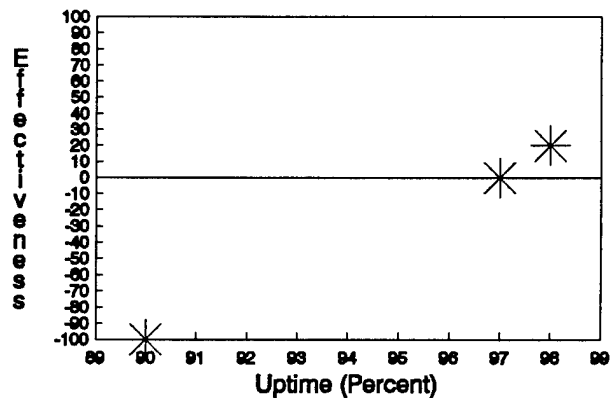


Figure 15 Starting an ME Chart.

If the Gold Team does not have any objection, these points are then connected with two straight lines (e.g. "Programming Efficiency" in Fig 14). However, Gold Teams may believe there is some reason to place an inflection point somewhere between points or to draw a curve (function) to represent the relationship between indicator value and mission effectiveness. That may be done as well. The Gold Team's wishes on how the points are connected must be strictly observed. Continuing with the example from Figure 15, it may be determined by the Gold Team that "Uptime" has a fairly shallow slope between 90% and 95%, but a steeper slope between 95% and the indifference point at 97%. The Gold Team may decide that

the ME points at 95% are about -80 and use straight lines to connect the points thus obtained (Fig 16). Sometimes the curve may take other, less common forms. More examples can be found in Weaver, Upton, & Frank (1992).

The facilitator repeats this process for each indicator until all indicators have an ME Chart. After ME Charts are completed, it is suggested that the Gold Team put away their charts for a couple of days and

then meet again to ensure the curves are correct. Such a "sanity check" can also be done at the time of the first feedback session. Later, when real data are available after one measurement cycle's data has been gathered, another feedback session with a sanity check is held.

After several sanity checks the TQM/MGEEM measurement system may be briefed to the appropriate level of management above the target organization. These managers should have studied Dr. Deming's (1986) philosophy and understand that the central purpose of TQM/MGEEM is to foster Dr. Deming's teachings, especially points 3 and 5 on inspection and continuous improvement of processes. They should be educated to resist their natural impulse to use TQM/MGEEM as another tool for micromanagement. They should understand Dr. Deming's advice that such action is the road to organizational ruin.

With the completion of the ME Charts, the formal TQM/MGEEM is now complete. This does not mean that TQM is "installed" and now will operate automatically. The most valuable steps in the TQM/MGEEM process are about to begin.

#### Using TQM/MGEEM To Maximum Benefit

It should be understood that the KRAs, indicators, ME charts and even the mission statement itself are not set in stone. All of these things should be considered to be living documents, changing as circumstances within and without the organization change with their features being especially sensitive to the spiraling expectations of customers. This is especially true of the indicators and ME charts. As processes improve (Weaver & Upton, 1992a&b), the feasible bests and worsts will change, and indicators may even become "maxed out" such that they are no longer effected by further improvement in the processes. As this happens, the target organization may need to redo some or all of the TQM/MGEEM

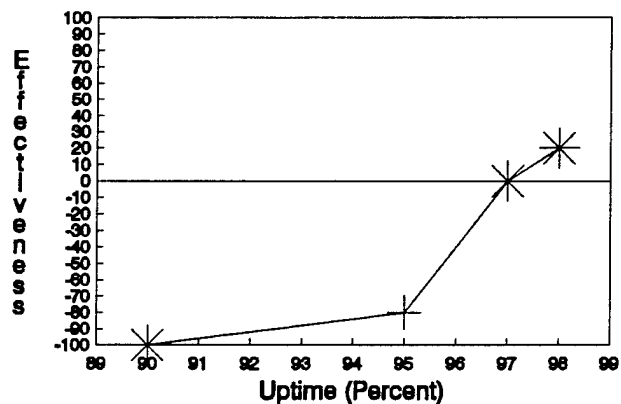
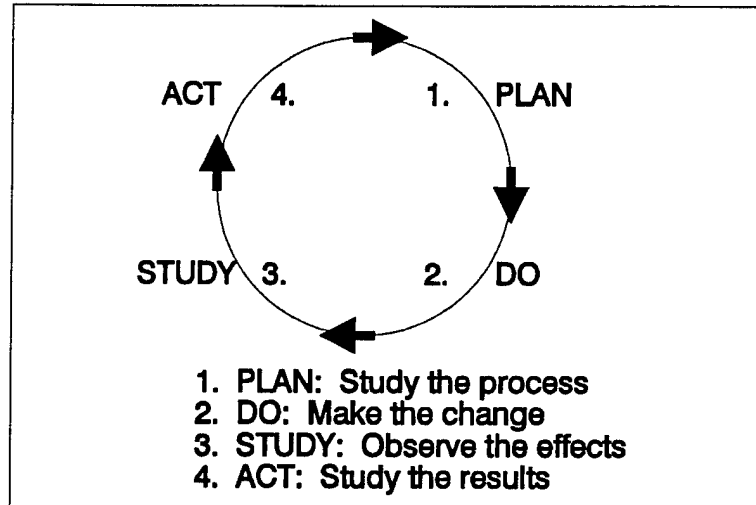


Figure 16 Finished ME Chart.

structure to continually improve its value as a basis for improvement. These decisions, as well as the use of the ME charts themselves through the philosophy of the Deming Cycle (Fig. 17, Deming 1986) is the final, continuing phase of a TQM/ MGEEM implementation and is discussed in detail in Weaver & Upton (1992b).



Using the ME Charts - the Feedback Team      **Figure 17 Deming Cycle.**

On a periodic basis, usually once a month but dictated by the measurement period of the indicators, leadership will need to meet with selected customers, suppliers and workers to review the ME chart data. It is at this time that review and changes may be made in the TQM/MGEEM system. The main purpose of a feedback team, however, is to review the information posted periodically on the ME Charts showing how the organizations processes are working (See Weaver & Upton (1992b) and "Phase 4: Feedback" in Weaver, Upton, & Frank (1992) for discussion of this vital part of TQM/MGEEM).

The first several feedback meetings may take place without inviting customers or suppliers as the organizational members conduct sanity checks and become familiar with reviewing the ME Charts. Later, customers will need to be invited to aid in identification of customer expectations. Also later, invitations to suppliers will be necessary to aid in improving the quality of the organizations inputs.

Well in advance of a projected feedback session, the representative customers and suppliers should be contacted and a time set for the feedback team meeting. This can be in conjunction with a regularly scheduled staff meeting or can be completely separate. In addition to the organization's commander/manager and mid-level supervisors, key workers should also attend to provide a forum for their unique and valuable ideas and perspectives. If the organization is small enough for a combination of the Blue and Gold teams, then all the members of the organization might be able to participate in these sessions. If there were two teams and the organization is large, workers should be identified on a rotating basis so that all interested workers will have a chance to participate at feedback sessions. In this context the relational definition of "workers" used for the Gold Team members is again used for the feedback team.

## Feedback

Feedback comes in two phases: first to management, and second to workers. The first can be accomplished in a normal staff meeting, the second will be most effective through the use of a feedback team meeting. A detailed explanation of the first is beyond the scope of this guide and can be found in "Feedback in TQM/MGEEM" in Weaver & Upton (1992b) along with more detail about worker feedback. The facilitator for these sessions may or may not be the same facilitator as was used for the development process. Eventually, these sessions may be facilitated almost entirely by the supervisor/commander of the target organization itself. For the facilitator, conducting a feedback session consists mainly of displaying the ME charts for the organization with the results for that work cycle posted on them and leading the team in discussion as to the areas they wish to improve and how best to address those concerns. For more information see "How feedback teams improve processes," Appendix B, Weaver & Upton (1992b).

## Improving the System

As mentioned at the beginning of this section, the TQM/MGEEM measurement system should not be set in stone. From time to time the organization will find it necessary to alter some or all of its components. Any part of the system, from mission statement to ME charts, may need alterations as mission needs, customers, suppliers, technology, circumstances, and TQM knowledge change. Minor changes may be accomplished during the feedback sessions, with full-blown Blue or Gold Team meetings only becoming necessary when major revisions are needed. It is paramount to remember that, like all systems within the organization, the measurement system must be continually improved to provide higher and higher quality to management, workers and customers.

## References

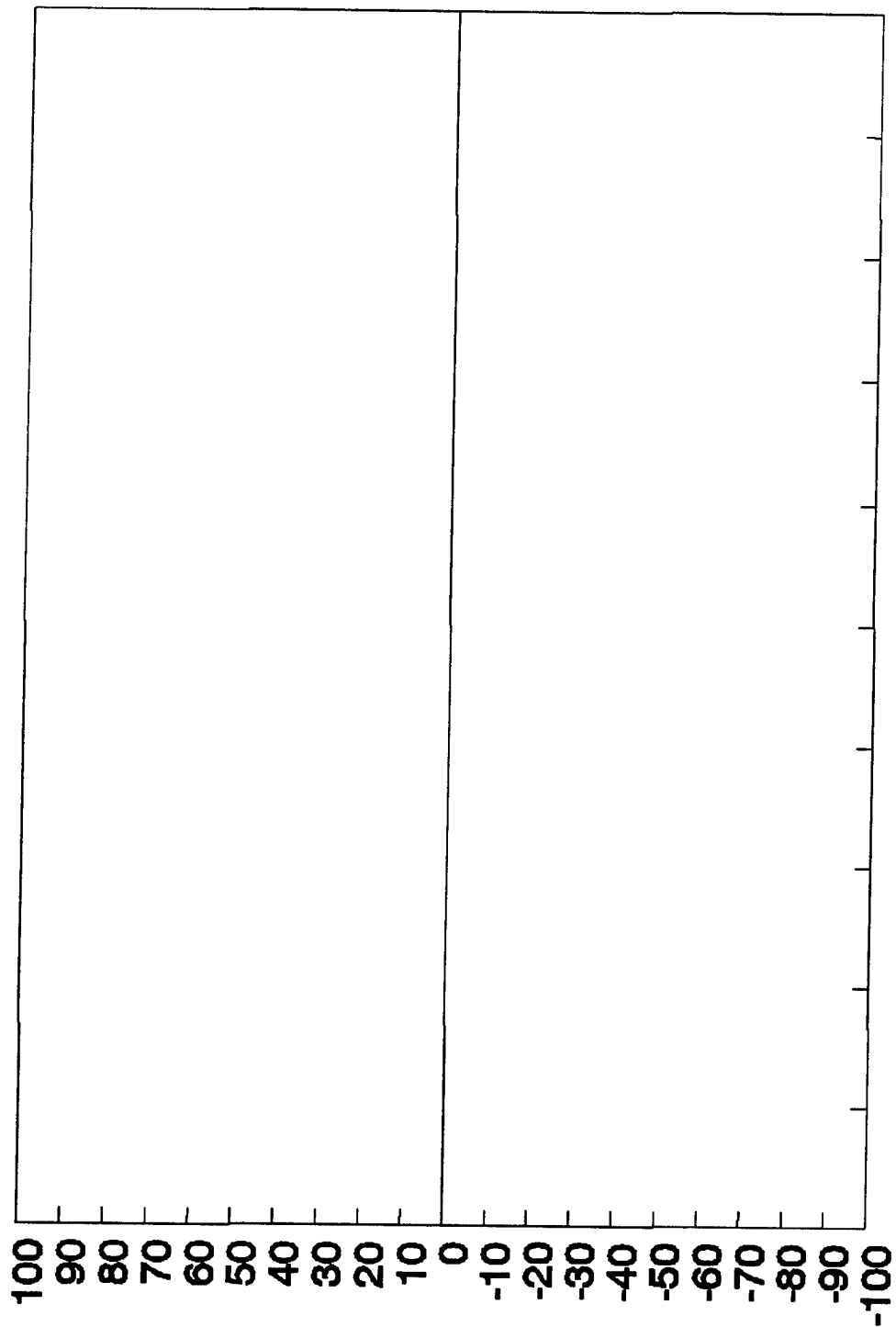
- Brassard, M. (1988). The memory jogger. A pocket guide of tools for continuous improvement. Methuen, MA: GOAL/QPC.
- Deming, W.E. (1986). Out of the Crisis. Cambridge MA: MIT.
- Deming, W.E. (1990). The Deming library. Vol 11. (videotape). Chicago, IL: Films Inc.
- Gitlow, H.S. & Gitlow, S.J. (1987). The Deming Guide to Quality and Competitive Position. Englewood Cliffs NJ: Prentice Hall.
- Juran, J.M (1989). Juran on leadership for quality. An executive handbook. New York: McGraw-Hill.
- Peters, T. (1987). Thriving on chaos. New York: Knopf.
- Upton, M.T. (1990). MGEEM: The software. Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.
- Weaver, C.N. & Looper, L.T. (1989). Methodology for generating efficiency and effectiveness measures (MGEEM): A guide for the development and aggregation of mission effectiveness charts (AFHRL-TP-89-7, AD A 208353). Brooks AFB TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.
- Weaver, C.N. & Upton, M.T. (1992a). Implementing total quality management (TQM) I: The command imperative. (AL-SR-92- ). Brooks AFB, TX: Manpower and Personnel Research Division, Armstrong Laboratory.
- Weaver, C.N. & Upton, M.T. (1992b). Implementing total quality management (TQM) III: Feedback and continuous improvement. (AL-SR-92- ). Brooks AFB, TX: Manpower and Personnel Research Division, Armstrong Laboratory.
- Weaver, C.N., Upton, M.T., & Frank, S. (1992). Implementing total quality management (TQM) IV: Technical guide. (AL-SR-92- ). Brooks AFB, TX: Manpower and Personnel Research Division, Armstrong Laboratory.

Appendix A: A Facilitator's Checklist for the TQM/MGEEM Process.

- I. Preparation
  - A. Familiarization with Target Organization
  - B. Identify members of Blue and Gold team
  - C. Set meeting time/date
  - D. Secure Room
  - E. Secure Needed Supplies
- II. Blue Team
  - A. Brief overview of TQM/MGEEM process and NGT
  - B. Review Mission Statement
    - 1. Review example mission statements
    - 2. Alter old or "straw man" mission statement
  - C. Identify Customers
    - 1. Discuss systems diagram (fig 1)
    - 2. NGT with abbreviated voting
      - "Who are the customers of \_\_\_\_\_"
    - 3. Pareto chart of results
    - 4. Discussion of "Critical" vs "Important" customers.
  - D. Identify Suppliers
    - 1. Review systems diagram
    - 2. NGT with abbreviated voting
      - "Who are the suppliers of \_\_\_\_\_"
    - 3. Pareto chart of results
    - 4. Discussion of "Critical" vs "Important" suppliers.
  - E. Identify KRAs
    - 1. Examples
    - 2. NGT: "What categories of results is this organization expected to accomplish?"
      - "What does the Air Force pay us to do?"
    - 3. Identify KRAs to include in parsimonious system.
- III. Gold Team
  - A. Brief overview of TQM/MGEEM process
  - B. Overlap members summarize Blue Team work
  - C. Identify Indicators for each KRA
    - 1. Brief theory of measurement, examples, characteristics of good indicators
    - 2. Start with first KRA
    - 3. NGT: "What quantitative indicator(s) should the manager of \_\_\_\_\_ track on a periodic basis to tell whether the KRA is being accomplished?"
    - 4. Identify indicator(s) for KRA
    - 5. Define specification/equation, source, feasible best, feasible worst, and indifference point.
    - 6. Choose next KRA, repeat steps 3-6 until indicators are identified for all KRAs.
  - D. Rank Indicators
    - 1. Prepare Indicator Weighing Table
    - 2. Rank and assign ME Point values to all indicators
  - E. Develop ME Charts



Appendix B: Blank ME Chart



**E f f e c t i v e n e s s**